How innovation intermediaries are shaping the technology market? An analysis of their business model

Lopez, Henry and Vanhaverbeke, Wim

ESADE Business School, University of Hasselt, Vlerick Management School

2009

How innovation intermediaries are shaping the technology market? An analysis of their business model

Henry Lopez-Vega[a,b] and Wim Vanhaverbeke[a,b,c]

[a]*ESADE Business School, Barcelona, Spain;* [b]*Hasselt University, Hasselt, Belgium;* [c]*Vlerick Leuven Gent Management School, Vlerick, Belgium*

Henry Lopez-Vega
Av. Torreblanca 59, 08172 Sant Cugat, Spain
Email: henry.lopez@esade.edu
Mobile: +34 (0) 6908-06839
Phone: +34 (0) 9355-43511

In an era with abundant and widely distributed knowledge across the globe, technology markets became prominent. As technology transactions suffer from several market imperfections, a rapidly increasing number of various innovation intermediaries are facilitating these transactions. We analyse how a subset of these intermediaries create value in a two-sided market and how they can capture part of the value. A detailed analysis of the business model of 12 innovation intermediaries clarifies how these organizations improve the effectiveness of technology markets providing benefits for both sides of the market. We also look at managerial trade-offs between the use of intermediaries' services and in-house innovation platforms.

Keywords: innovation intermediaries; open innovation; business model; two-sided markets

Introduction

Open Innovation points to the need for a two-way traffic of ideas: into companies to strengthen the competitiveness in their existing businesses, and out of companies in order to find external business opportunities for monetising their own ideas (Chesbrough 2003). Over the last few years, open innovation scholars have focused on identifying imperfections and opportunities in external technology markets and on companies' internal responses to these opportunities and the need to create value for the firm. They highlight the daunting managerial task of designing business models capable of integrating dispersed, external sources of knowledge (Johnson et al. 2008) and generating profit from anomalies and uncertain market opportunities (Arora and Gambardella 2010).

In response to this challenge, a particular kind of innovation intermediary (of which NineSigma, InnoCentive, Creax are prime examples) has emerged over the last decade to help companies lacking an 'adaptive' business model to transgress their own boundaries and access external technological markets (Chesbrough, 2006). These innovation intermediaries actively connect the supply and demand sides of the market, forging links between firms searching for external ideas (innovation seekers) with communities of highly-qualified solution providers (innovation solvers). Yet, despite the substantial research on open innovation, scant attention has been paid to the content, structure and governance mechanisms of these emerging forms of innovation intermediaries.

This paper attempts to disentangle this particular innovation process by: (a) connecting applications from the two-sided market literature (Rochet and Tirole 2003; Eisenmann et al. 2000), (b) briefly reviewing the features of technology markets (Arora and Gambardella 2010) and (c) open innovation (Chesbrough et al. 2006) to the underlying business models of innovation intermediaries (Chesbrough 2006). More specifically, we are interested in the innovation intermediaries' business model and how it creates and captures value in two-sided technology markets. Our analysis reveals that innovation intermediaries contribute to open innovation by accelerating two-sided flows of knowledge in line with the theoretical insights developed in the two-sided market literature. Furthermore, this study shows the different approaches adopted by intermediaries for helping companies throughout the open innovation process. As a result, this paper provides the first study of innovation intermediaries' business models and details their contribution to the recent surge in the development of technology markets.

The paper is structured as follows: the next section presents our theoretical approach to the study of innovation intermediaries in two-sided markets. Section 3 discusses how organizational characteristics are studied through the perspective of a business model framework. Section 4 discusses our research design and section 5 presents the results of the analysis. Section 6 discusses the managerial trade-offs in using external or internal innovation intermediaries to capture external knowledge. The last section concludes with our findings and their implications together with suggestions for further research.

What are the characteristics of (open) innovation intermediaries?

In an era with abundant and widely distributed knowledge, technology transactions and partnerships with external partners became more prominent in firms' innovation strategies (Chesbrough et al. 2006). For decades, various scholars have shown that technology transactions and markets are prone to different types of market imperfections (Arrow 1962; Arora et al. 2001; Arora and Gambardella 2010). Over the last decade, companies have shown growing interest in transacting technologies with external partners. A rising number of cases revealed firms make use of services offered by innovation intermediaries. These, however, are ubiquitous and a clear definition of such innovation intermediaries would sharpen the focus of this paper but none is to be found in the literature to date.

Recently, in an attempt to shed some light to these studies, Howells put forward a broad definition of an innovation intermediary as "an organization or body that acts as an agent or broker on any aspect of the innovation process between two or more parties. Such intermediary activities include: helping to provide information about potential collaborators, brokering transactions between two or more parties; acting as mediator, or go-between, bodies or organisation that are already collaborating; and helping find

advice, funding and support for the innovation outcomes of such collaborations (Howells 2006 p. 720)". Although this proposed definition embraces significant activities and forms of intermediaries, it does: (a) not reveals differences among widely-studied groups of intermediaries; (b) not explains the reason d'être and differentiating characteristics of emerging innovation intermediaries such as NineSigma, Innocentive, Big Idea Group, InnovationXchange, IP Exchange and Ocean Tomo, etc. (Chesbrough 2006) and (c) includes agent based intermediaries which are excluded from the analysis in this paper.

Empirical observations indicate that such intermediaries may speed the quest for possible solutions to a customer's problems or help firms license or sell internally-developed technologies that they cannot turn into products of their own. Innovation intermediaries do this by: drawing on an international network of potential innovation solvers and helping inventors find innovation seekers. Chesbrough (2006) explained this new breed of innovation intermediaries emerged in a "rich environment of abundant and widely distributed knowledge" that required third parties capable to overcome barriers conditioning the functioning technology markets.

Let us take NineSigma as an example of an open innovation intermediary. This small firm was established in 2000 and has since helped over 300 organisations worldwide to find solutions from an external network of 2 million providers drawn from 16 industrial groups and 115 countries. Since its foundation, it has guided over 1,600 open innovation projects and successful technology development agreements, doing US $ 10 m of business in 2008.

Ninesigma's simplified innovation process entails six steps. The first one involves a series of activities between an innovation seeker (e.g. P&G) and the intermediary's representative to find a strategy to best meet open innovation i.e. convert

a business challenge into a confidential request for a solution, assess technology landscape, identify success metrics. Next, a request is sent to the international network of solution providers (companies, technology centres, and individual scientists). Third, solution providers comb through their existing technologies and capabilities. If they think they can provide a solution, they submit an initial Proposal for Request (PFR) to the intermediary. These submissions are then gathered together and sent to the solution seeker (there are around 90 PFRs per challenge and around 40% of the submitting firms are new to the game). Fifth, innovation seekers evaluate the technical, commercial and relational feasibility of received solutions. This process involves several ongoing meetings between selected innovation solvers and solution seekers' representatives (or innovation champions). During the last step, innovation seekers select one technological solution, agree future collaboration, IP acquisition or possible partnership with the innovation solver and settle the intermediation fees. Throughout these six steps, NineSigma may provide additional services to technology seekers extracting more value from its network. Furthermore, an unexplored step involves the assessment of technology adoption, identification of unmet technology needs and measurement of success and future steps.

Opmerking [HL1]: Wim, I'm not sure whether these confidential information should be used

Opmerking [HL2]: Wim: we commented that this step is a major current constrain for 9Sigma. Shall we include it?

NineSigma is an example of an emerging group of innovation intermediaries (Chesbrough 2006; Huston and Sakkab 2006; Lichtenthaler and Ernst 2008) that create value by enabling and facilitating (technology based) transactions between players in a two-sided market. The innovation intermediaries' strengths are:

- The ability to facilitate collaboration across two sides of technology markets by creating innovation platforms that link companies match seekers with potential innovation solvers (the latter include scientific entrepreneurs, retirees, public and private research labs, etc.).

- Providing an attractive price structure for innovation seekers who only pay the innovation solver and the intermediary if and when they acquire, in-license the proposed solution. Innovation intermediaries do not pay solvers a monetary compensation for their time and effort. However, offer them valuable business access to potential end customers and allow solution providers to search business challenges through other intermediaries.
- Providing innovation seekers with complementary services, which include strategic advice, technology-mapping, integration services, etc.

Most studies on intermediaries in two-sided markets have emerged from research on network externalities and multi-product pricing (Rochet and Tirole 2003; Parker and van Alstyne 2005; Eisenmann et al. 2006). According to Rochet and Tirole (2006 p. 664-665) "a market is two-sided if the platform can affect the volume of the transactions by charging more to one side of the market and reducing the price paid by the other side … The market is one-sided if end-users negotiate away the actual allocation of the burden … ; it is also one-sided in the presence of asymmetric information between the buyer and the seller, if the transaction between buyer and seller involves a price determined through bargaining or monopoly". Two-sided markets, according to Parker and van Alstyne (2005), require the interaction of three groups of actors; a group of technology buyers, a group of sellers and an intermediation 'platform' that creates tools or mechanisms for helping both parties strike a deal.

Another literature stream has focused on the growing importance of the market for technology (Arora et al. 2001, Arora & Gambardella, 2010), which is disembodied from physical goods. The focus is mainly on the efficiency of technology market transactions and the division of labour between those licensing their technology and firms seeking it to new products and businesses. However, this literature focuses

strongly on bilateral technology transactions such as R&D contracting and licensing between technology specialists and buyers. To the best of our knowledge, the role played by innovation intermediaries in bringing technology suppliers and technology buyers together in a triangular trading arrangement has yet to be discussed within this framework.

Research on open innovation not only stresses that knowledge is both plentiful and widely distributed across the globe (Chesbrough et al. 2006). The literature stream also acknowledges various challenges in accessing and acquiring external knowledge such as identifying useful external knowledge sources, efficient scaling, and establishing technology markets. These all pose hurdles to the management and organisation of open innovation in companies, etc. Chesbrough (2006) provides in-depth analysis of several innovation intermediaries whose platforms help two-sided technology markets work. He describes innovation intermediaries as entities that harness the integration of various knowledge sources and advise firms on how to capture the benefits of external and/or internal knowledge flows. Following this line of thought, we narrowly define such innovation intermediaries thus: " platform providers in ***two-sided innovation markets created to co-ordinate the flow of innovation requests and solutions across distinct, distant and previously unknown innovation actors"***. There are two merits to this definition. First, it acknowledges the existence of other innovation/knowledge intermediaries (Howells 2006; Winch and Courtney 2007; Verona et al. 2006) – for example incubators (Gassman 2006; Hansen et al. 2000), university science parks (McAdam et al. 2006;Youtie and Shapira 2008) and consultancies (Hargadon and Sutton 1997; Bessant and Rush 1995). Second, it highlights the characteristics of innovation intermediaries which acts as platform

providers in two-sided technology markets and which have been described in Lichtenthaler and Ernst (2008), Chesbrough (2006) and Huston and Sakkab (2006).

We shall now look at several factors that determine the commercial success of this subset of intermediaries. Eisenmann et al. (2006) derive a number of factors from theoretical models about two-sided markets as explained by Parker and van Alstyne (2005), Rochet and Tirole (2003, 2006) and others.

Intermediaries are considered as *platforms* whose infrastructure and rules facilitate transactions between two sides of the market. Innovation intermediaries provide value to companies in search of solutions, IP, other services or resources by taking away the expensive search processes. This is especially interesting when the supply side of the market is highly scattered. For individuals and groups at the supply side innovation intermediaries provide a window opportunity to successfully commercialize their invention, solution or technology.

Innovation intermediaries usually stimulate the growth of both seekers and solvers because theirs is not a zero-sum game but rather one in which adding value to one side fosters growth on the other. This cross-side network effect is crucial in explaining the commercial success of innovation intermediaries. Acquiring new participants on both sides of the market boosts the value offered by the innovation intermediary. The remorseless logic of increasing returns to scale means that two-sided markets are usually fiercely competitive and ones in which "the winner takes all".

This is also the case for innovation intermediaries. Early entrants can gain first-mover advantages. Late entrants are clearly at a disadvantage but they can adopt a differentiation strategy given that innovation seeker needs are varied and each intermediary can offer a different kind of service, focusing on other sorts of clients or specialising in different technological fields. As a result, innovation intermediary start-

ups have boomed over the last 5 years. However, we can expect that the growth of networks will lead to growing consolidation in the industry as larger innovation intermediaries start to acquire smaller ones. UTEK's pharmalicensing and Tekscout (acquired in January 2008) initiatives are a sign that the process is already underway.

The consolidation trend will be further strengthened by the diversification strategies of larger innovation intermediaries. Here, one should note that intermediaries offering different types of services often have overlapping customer bases and thus shared relationships could be leveraged if an innovation intermediary can bundle together what is only offered piecemeal by his competitors. Some intermediaries are already diversifying by offering kindred services to their clients but so far this has been the result of an organic growth strategy. One might expect that more and more intermediaries will diversify through acquisition.

In two-sided markets, pricing is more complicated than in one-sided markets, as intermediaries have to choose a price structure, taking into account that the growth on one side of the market increases the other side's willingness to pay. Innovation intermediaries often have a price structure to "subsidise" one-side of the market to boost demand and the other side's disposition to fork out. Frequently, innovation intermediaries may attract large numbers of (price-sensitive) innovation solvers by offering free membership. However, when small groups of price-sensitive innovation solvers are signed up, the chance of any one of them providing the winning solution is low. This is the case for platforms such as Innocentive and Ninesigma, which need over 100,000 innovation solvers to constitute an attractive platform for major innovation seeker clients. This low hit rate is a logical consequence of clients' highly specialist needs, which few solution providers are in a position to satisfy. In turn, more paying clients make the platform more attractive to solution providers. However, this is not

Opmerking [HL3]: Wim wrote: This is specially the case when large groups of price sensitive solution providers are requested and the chance of providing a winning solution is low. –IS IT CORRECT-

always the case. Yet2.com charges both sides of the market because IP-trading may generate large benefits for both sides and a "membership fee" may also give companies greater incentives to use the platform.

"Same-side" network effects are usually not present among solution providers because most intermediaries thwart such links. Innovation solvers are not only isolated from innovation seekers but also from other solvers because anything else would threaten the middleman's position. Similarly, same-side effects do not exist among innovation seekers as they only establish bilateral transactions with the platform provider. Information leaks may constitute a serious problem and intermediaries have to observe the strictest confidence and secrecy (Chesbrough 2006). As such, strategic information about innovation seekers should not leak to other innovation seekers using the same innovation intermediary services. In addition, firms' collaborating with innovation intermediaries face "Arrow's information paradox" (Arrow 1962): that is, in seeking a solution firms are forced to reveal information in seeking a solution but must conceal the firm's technological weaknesses to potential competitors. Researchers and engineers working for solution providers might get wind of such weaknesses. Finally, innovation seekers should protect themselves from contamination: if a client firm receives a solution from a supplier through an innovation intermediary, then "any consequent internal development in a related area by the [...] [former] may be challenged by the supplier..." (Chesbrough 2006 p. 68). Therefore, an intermediary has to insulate client firms "...from inadvertent exposure to external ideas, unless those ideas become paid solutions". (Ibid p.143).

Business models defined

Although no consistent definition of business models can be found in the literature, most scholars emphasise the relevance of value creation and capture mechanisms. On

Opmerking [HL4]: I don't think this part should be in this section. Either delete it or move it at the beginning of next section (understanding innovation intermediaries' business model). It is relevant because it provides a definition of business models.

OK? yOU CAN INTEGRATE IT IN THE NEXT PART (BEGINNING)

the one hand, value creation (or value proposition, as it is also known) refers to the articulated logic, method or services offered to customers. On the other hand, value capturing refers to the design of the internal revenue and cost streams for delivering the created value (Johnson et al. 2008; Morris et al. 2005; Chesbrough 2003). Value capturing is the process through which a firm generates profits by creaming off some of the value created. Besides value creation and value capturing, there are four other dimensions in a business model. We adopt the definition of business models recently proposed by Teece (forthcoming). He defines business models as:

> "…the design or architecture of the value creation, delivery and capture mechanisms employed. The essence of a business model is that it crystallizes customer needs and ability to pay, defines the manner by which the business enterprise responds to and delivers value to customers, entices customers to pay for value, and converts those payments to profit through the proper design and operation of the various elements of the value chain (Teece 2010 forthcoming)"

Recently, the design of business models has attracted scholars' attention because it entails highly complex entrepreneurial and managerial analysis of market opportunities. By the same token, early-established innovation intermediaries identified the opportunity created by the increasing technical capabilities of external suppliers and the need to rein in the soaring costs of technology development (Chesbrough 2007, 2003). Innovation intermediary platforms were conceived as a way of tackling closed innovation problems through innovation networks for matching innovation needs from innovation seekers (e.g. P&G, Unilever) and capabilities embedded in innovation solvers.

Understanding innovation intermediaries' business models

The literature on two-sided markets, technology markets and the few open innovation publications covering intermediaries have provided some interesting insights on their role and functioning. This section analyses the business model of these platform providers and will furnish a detailed picture of how innovation intermediaries create and capture value and how they can compete effectively.

Let's first have to look at some particularities of platform providers. First, the choice of a business model for innovation intermediaries takes into account price structure as the central plank in the revenue model because 1) cost and revenue come from both sides (Eisenmann, 2006) and 2) breakdown and allocation of transaction fees matter to the success of a platform (Rochet and Tirole, 2003). Second, the design of business models has to identify ways of fostering network growth on both sides of the market – posing a "chicken & egg" dilemma (i.e. platform success depends on having a large, diverse pool of solution providers but these are only interested in the network if it contains a large number of innovation seekers).

The rise and growth of technology markets not only drove the emergence of new innovation brokers but also fostered value creation for their customers and ways of creaming off part of this to build a profitable business. For example, in two-sided markets, intermediaries could create value by either offering an established community of solution providers (e.g. InnoCentive, NineSigma, IdeaConnection.com) or providing an IP merchant bank set-up between inventors and organizations (e.g. Ocean Tomo). According to Teece (forthcoming), business models deserve more attention from both scholars and practitioners. Although remarkable contributions include research on contingency factors (Zott and Amit 2007) or categories (Johnson at al. 2008; Morris et al. 2005; Chesbrough and Rosensbloom 2002), scholars in organisational, strategic and marketing sciences still consider business models simply are not necessary to

understand strategic management (Teece forthcoming). This section highlights the relevance of research on business models through the discussion of breakthrough insights (see forthcoming special issue on business models in Long Range Planning journal) and major categories for comparing and analysing business models.

Exploring business model characteristics

The overall architecture, strategy and growth potential of business models can be studied in detail using the following six functions (Johnson et al. 2008; Chesbrough and Rosenbloom 2002; Morris et al. 2005).

- *Value creation* refers to the characteristic mechanisms or processes designed to satisfy customer demands. These are grouped under four value creation drivers (Amit and Zott 2001). First, the novelty-centred business model design is associated with a firm's ability to link previously unknown parties through new transaction mechanisms (Zott and Amit 2007)". Second, efficiency-centred design refers to mechanisms for cutting transaction costs. Third, called "lock-in" covers ways of ensuring external partners engage in repeated transactions through trust-based relationships with customers. Fourth, the complementary driver covers the gain to customers' from bundled products or services.
- *Value capture* or revenue architecture refers to managers' decisions and mechanisms for assigning prices and exacting payment.
- *Value chain* denotes the internal and external resources, competences and processes needed to meet customers' demands. Resources include people, technology, equipment, information channels, vertical and lateral partnerships and alliances (Johnson et al. 2008).

- *Market segment* covers market size, matching the firm's goods and services to: market volume, current and future customer requirements, geographic and demographic characteristics.
- *Value network or ecosystem* refers to managers' identification of the main co-operative and complementary points of differentiation to enable sustainable, non-imitable arrangements among suppliers, customers and competitors.
- *Competitive strategy* refers to managers' decision regarding present and future resource allocation and mechanisms for securing and sustaining competitive advantage.

We will use these six functions to describe the design/ architecture of value creation, delivery systems, and value capture mechanisms in the business models of various innovation intermediaries. This should give us a more detailed picture of how they deliver value to customers on both sides of the market and how they generate profits by setting price and cost structure. Before we apply business models to these intermediaries, we shall explain in the next section how we selected the innovation intermediaries.

Research design

Sample selection

The literature review suggests innovation intermediaries are broadly understood as any organisation acting as a broker in the innovation process (Howells 2006) or offering services in the field of open innovation (Diener and Piller 2009). This leads to the wrong assumption that third parties act as (open) innovation intermediaries in technology markets. Examples of the former kind of intermediaries include technology transfer offices, science parks and incubators. Although groundbreaking research

(Hargadon and Sutton 1997; Becker and Gasman 2006; McAdam et al. 2006) has explained how these third parties facilitate innovation, little attention has been paid to innovation intermediaries acting as two-sided innovation platforms (praiseworthy exceptions are Verona et al. 2006 and Lichenthaler and Ernst 2008).

Although we interviewed a large sample of the aforementioned intermediaries[1] for this paper, we decided to include only those innovation intermediaries co-ordinating the flow of innovation requests and solutions between distinct, distant and previously unknown innovation actors. As such, our definitive sample included 12 innovation intermediaries (see Appendix 1) that were analogous in facilitating innovation and not engaging in design or other non-innovation related activities. We not only drew up a sample that excluded other kinds of intermediaries but also searched for sufficient heterogeneity regarding the stage of the development, type of challenges solved, the provision of complementary services, and size (number of staff or size of network).

Data Collection

Two data-gathering methods were employed. First, we conducted extensive interviews at 3 innovation intermediary firms with senior managers including CxOs and R&D directors of innovation areas. All interviews were face-to-face and lasted at least an hour, providing respondents plenty of time to explain the various business model functions. Finally, interviews were transcribed via interview notes (McCracken 1988).

Second, we carried out a profile check on the remaining innovation intermediaries, checking from publicly available sources, including company websites and press reports on the firms' business activities. This information came from two

[1] We would like to thank the two anonymous reviewers for suggesting limiting the data analysis to (open) innovation intermediaries.

sources: a) researchers explored and presented the business model functions from different innovation intermediaries; b) they reviewed the analysis provided and validated the responses with further checking of additional information sources. This method improved the reliability of replicable findings (Yin 2009) and strengthened the convergence of perceptions.

Analysis methods

For this paper, we adopted techniques for cross-case analysis (Miles and Hubermann 1994; Yin 2009) to explain the business model functions of innovation intermediaries. We used analytical techniques of pattern matching to connect the 6 business model functions (Chesbrough and Rosenbloom 2002) with the collected data. This inferential approach was chosen for this research in the absence of any alternative approach for explaining and comparing business models. The aim was to bring forward business model functions and match our data to explain the characteristics and differences between various kinds of intermediaries. Finally, we triangulated and integrated the data and clarified the major categories of innovation intermediaries.

Results

Initially, the novelty of innovation intermediary platforms was on facilitating and broadening managerial access to external technological solutions. Our inductive analysis of 12 intermediaries' business models revealed an ongoing evolution their content, structure and governance mechanisms as well as range of activities, customer segment and price structures. Following, the results of our data analysis are presented in table 1 and some illustrations of the business model functions are discussed next.

Table 1. Around here

Value creation

A characteristic of innovation intermediaries is their capability to create value for customers at the two-sides of technology markets. On the one hand, value is created for innovation seekers by offering: (a) access to organized external networks of qualified solution providers to solve confidential innovation challenges or partnering for business development opportunities; (b) transfer or license opportunities of IP or technologies and (c) services to develop external technologies and embed open innovation within organizations. On the other hand, value is created for solvers when an innovation intermediary enables them to: (a) apply their knowledge to technological challenges; (b) sell or license proprietary technologies and (c) identify possible market applications for existing technologies.

Our results reveal two value creation drivers (Zott and Amit 2007) were predominant on early-established innovation intermediaries – e.g. NineSigma, InnoCentive, Ocen Tomo, and Yet2.com. First, novelty was observed on new established mechanisms of transaction between innovation solvers and seekers through the use of a two-sided innovation intermediaries in technology markets. By the same token, innovation intermediaries created value through complementary services necessary to identify and develop solutions for innovation seekers. However, innovation intermediaries could not establish mechanism to 'lock-in' because both innovation seekers and solvers were able to do multi-homming and did not have market power.

Value capture

We identified innovation intermediaries subsidize the participation of innovation solvers to increase the number and quality of solutions for innovation seekers. Although this price structure is a typical characteristic in two-sided markets, value creation for innovation intermediaries occurs most of the cases when successful innovation seekers obtain results. Innovation intermediary platforms capture value from innovation seekers from: (a) a percentage or a fixed fee from the award given to winning innovation solvers; (b) up-front posting fee to send an innovation challenges to external networks; (c) consultancy services. Table 1 shows that in most cases innovation intermediaries do not capture value from the supply side because solvers' participation is subsidized to increase the likelihood of a successful solution for innovation challenges. Our results reveal, however, some intermediaries i.e. Pharmalicensing, Yet2.com or ICAP Ocean Tomo have price structure mechanisms to capture value from innovation solvers (IP sellers) by: (a) charging a success fee or fixed commission for licensed transactions to innovation solvers, (b) posting their available technology offers or profile and (c) charging an annual membership fee.

Value chain

The different mechanisms to create and capture value from two-sided markets constrained innovation intermediaries to design difficult to imitate value chains. A closer look reveals two prevalent value chain models, one the one hand, one group is focused on assisting to find solutions for innovation challenges and the other to accelerate technology or IP transfer among companies. The former model is predominant on early stage and recently established innovation intermediaries e.g. InnoCentive, NineSigma, TekScout that assisted companies from the selection of an internal innovation challenge to its development and market commercialization. A closer look reveals the resources and structure lead to strategic decisions to perform

internally or externally outsourced innovation intermediaries' activities. A second model was identified at innovation intermediaries such as Pharmalicensing, ICAP Ocen Tomo, Yet2.com that established mechanisms to facilitate the match of technologies or IP between solvers and seekers.

Market segment

In two-sided technology markets, innovation intermediaries are conditioned to increase the size of innovation solvers and seeker communities to create cross-side network effects and create value to innovation processes. As such, the innovation seekers side of the market includes Blue chip companies, not exclusively ranked on S&P 500 or Fortune 500, but also other large companies in European markets that continuously do research or launch new products. The innovation solvers side of the market includes private organizations, university and governmental labs, private or public research institutes, retirees from different sectors and distributed across the world. A characteristic of innovation solver communities is on its large number and legitimate capacity to simultaneously work for different innovation intermediaries.

Value network

Innovation intermediaries continuously search for strategic alliances with new external actors on both sides of the market. On the one hand, strategic cooperative arrangements with foundations, large companies or public institutes attract more innovation solvers to be part of the innovation solver community. On the other hand, complementary arrangements with a broader range of innovation consultants, technology centers and other international innovation intermediaries benefits the provided open innovation solution service for innovation seekers.

Competitive strategy

We observed established innovation intermediaries have similar ongoing strategies to nurture its 'orchestrating' role in two-sided technology markets. First, strong network externalities are necessary to engage large communities of innovation solvers that could solve innovation challenges. For established innovation intermediaries, a large community of innovation solvers increases the chances of an innovation seeker to obtain a useful solution, whereas others in smaller size have to make use of advertising or strategic alliance mechanisms to receive innovation challenges from companies. Second, innovation intermediaries may compete providing open innovation consultancy services to facilitate the identification, selection, development and market commercialization of technologies, whereas smaller innovation intermediaries outsource these services to other external firms. Finally, innovation intermediaries' strategy also entails an efficient platform to facilitate the matching of specialized technology offers and requests. Also, our analysis reveals innovation intermediaries' future competitive strategies are: (a) improvements on software matching and codifying mechanisms, (b) provision of new innovation services, and (c) internationalization of its operations through new subsidiaries or collaborative alliances.

Alternative one-sided innovation platforms

Any analysis of innovation intermediaries should take into account the innovation portals set up by several large companies such as Procter & Gamble, Unilever, Starbucks, Kraft, Pfizer, Lego and Dell. Their corporate websites connect them directly with external innovation partners and form part of a strategic decision. As a result, these large firms take a two-pronged approach: they are clients of several innovation intermediaries and they have their own portals targeting external innovation partners.

We try to unravel why companies adopt this strategy. What are the advantages of working with innovation intermediaries and when does it pay to have one's own portal?

An advantage of corporate portals is that the firm is no longer forced to play a single role but instead can relate to many kinds of external innovators at the same time. P&G, for instance through connect + develop (C&D), not only seeks technical solutions to its needs but also allows website visitors to see those technologies that have applications outside P&G's core products and markets. Yet2.com provides the search engine used on the company's website. Thus this strategy allows P&G to access an external network of clients, through the C+D, and simultaneously co-ordinate part of their challenges with several kinds of innovation intermediaries.

Of course, a portal only works for large companies with very strong corporate brands. It is no surprise to find that the companies involved in B2C activities are large ones with worldwide reach. Their brand names are sufficiently well known to attract large numbers of potential external technology partners. B2B companies would find it much harder to set up a comparable network. Likewise, smaller firms would also find it tough if not impossible to create a network that was large enough to be worthwhile. The difference with communities of users established by many (small) companies is that a technological community has to be large and global in scope to be effective. By contrast, small regional user communities may still be viable.

Organizations with a portal also benefit from their direct contact with the innovation community. This is the case when an organization is looking for technologies for which no strategic information is revealed on its web site dissemination. It can search for solutions on a permanent base instead of working on a project with an intermediary within a relatively small time frame. Similarly, it can advertise the technologies it wants to sell or license and shape the contract in a way that

benefits both parties. However, this should not blind one to the advantages to working with intermediaries. First, companies have to rely on these where anonymity is required. Organizations seeking a technological solution or selling a technology do not want competitors or investors to zero in on them. Moreover, intermediaries can play a crucial role in solving the problem of contamination. An innovation intermediary may have a much larger network of solution providers or its network might differ in some important way from that furnished by the client's own portal. Hence a firm can still benefit from working with intermediaries even when it has its own portal. While the aforementioned companies aim to become the solution providers of choice, many potential partners are scared of contacting a large corporation that has many irons in the fire. Given that the company screening a proposal may also be the potential buyer, many solution providers opt to work only with neutral intermediaries.

Some companies such as Dell and Starbucks use their portal mainly to get feedback from users. It is an interesting way of keeping in touch with users and gleaning direct feedback on the firm's products and ideas. It also generates ideas for new product launches.

Conclusions and managerial implications

Open innovation implies that companies make much greater use of external ideas and technologies in the development of their own products and businesses, while they let their unused ideas be used by other companies (Chesbrough 2006). Open innovation offers the prospect of deploying firms' knowledge base more effectively, of shortening the time to market, and of lowering R&D costs and risks. However, as more external ideas flow in from the outside and internally developed knowledge flows to the outside, problems related to co-developing and transferring knowledge become more

prominent than ever before. We have been focussing in this study on one particular problem, i.e. how companies in search for external technical solutions, IP, or other innovation related resources can be assisted in their search by innovation intermediaries. More specifically, we have been focusing on the role of innovation intermediaries in two sides markets (in contrast to the agent based intermediaries).

In order to analyze the role of innovation intermediaries, which became popular as described by Chesbrough (2006), we brought together different literature streams and applied the insights from each on them on this new phenomenon within the open innovation landscape. We borrowed insights from different literature streams such as the two-sided market literature (Rochet and Tirole 2003; Eisenmann et al. 2000), technology markets (Arora and Gambardella 2010), and open innovation (Chesbrough et al. 2006). Combining the insights from these literature streams provided an interesting picture of their role and how they create and capture value in two-sided technology markets. Next, we focussed on the business models of 12 innovation intermediaries to get a more accurate picture of how they generate benefits for a specific group of customers and how they a profit in doing so. Our analysis reveals that innovation intermediaries contribute to open innovation by facilitating inter-organizational flows of knowledge in a two sided markets by offering a platform where the two sides of the market can get connected. As predicted by the two sided markets literature, innovation intermediaries typically subsidize the price-sensitive side of the market (usually solution providers) especially when uncertainty is high and, as a result, a large population of solution providers is required to guarantee a successful transaction. Since network externalities are important in two-sided markets, innovation intermediaries are expected to face fierce competition once the growth of the market is slowing down. It's a winner take all competition and take-overs can be expected in the

future. The consolidation trend will be further strengthened by diversification strategies of larger innovation intermediaries However, innovation intermediaries can differentiate and offer different kinds of services, focusing on other types of clients or specialising in different types of services. As a result, new entrants have a possibility to avoid head-on competition through differentiation. In contrast, solution seekers may prefer companies offering a broad range of services.

As open innovation becomes more popular companies increasingly face a growing number of competitors with equal access to non-proprietary knowledge. Open innovation has become a competitive necessity and is no longer is no longer automatically leading to a competitive advantage. Innovation intermediaries are a powerful force rendering external innovation accessible to every company. To earn returns from open innovation, companies must nowadays integrate their collaboration with innovation intermediaries within an overall innovation strategy. Their internal organization should be adapted to the rapidly changing potential that the growing number of intermediaries offer them. Companies that manage to profit from open innovation are those that adapt their innovation processes and organization in line with the new opportunities the intermediaries provide. In other words, open innovation in a company, should be a dynamic process that co-evolves with changes in the technology markets, which are partially driven by the exploding number of possibilities offered by intermediaries and technology service companies.

References

Amit, R. & Zott, C. 2001, "Value creation in E-Business", *Strategic Management journal,* vol. 22, no. 6-7, pp. 493-520.

Arora, A., Fosfuri, A. & Gambardella, A. 2001, *Markets for technology: The economics of innovation and corporate strategy,* The MIT press, Cambridge,MA.

Arora, A. & Gambardella, A. 2010, "Markets for technology" in *Handbook of Economics of Innovation*, eds. B.H. Hall & N. Rosenberg, Elsevier, Amsterdam.

Arrow, K. 1962, "Economic Welfare and the Allocation of Resources for Invention " in *The Rate and Direction of Inventive Activity: Economic and Social Factors*, ed. H.M. Groves, National Bureau Committee for Economic Research, Cambridge, MA, pp. 609-626.

Becker, B. & Gassmann, O. 2006, "Gaining leverage effects from knowledge modes within corporate incubators", *R&D Management,* vol. 36, no. 1, pp. 1-16.

Bessant, J. & Rush, H. 1995, "Building bridges for innovation: the role of consultants in technology transfer", *Research Policy,* vol. 24, pp. 97-114.

Chesbrough, H. 2007, "Business model innovation: It's not just about technology anymore", *Strategy & Leadership,* vol. 35, no. 6, pp. 12-17.

Chesbrough, H., Vanhaverbeke, W. & West, J. 2006, *Open Innovation: Researching a New Paradigm,* Oxford University Press, Oxford.

Chesbrough, H. 2006, *Open Business Models: How to Thrive in the New Innovation Landscape,* Harvard Business School Press, Boston, MA.

Chesbrough, H. 2003, *Open Innovation: The new Imperative for Creating and Profiting from Technology,* Harvard Business School Press, Boston, MA.

Chesbrough, H. & Rosenbloom, R.S. 2002, "The role of the business model in capturing value from innovation: Evidence from Xerox Corporation's technology spin-off companies", *Industrial and Corporate Change,* vol. 11, no. 3, pp. 529-555.

Diener, K. & Piller, F.T. 2010, *The market for open innovation,* RWTH-TIM Group, Germany.

Eisenhardt, K. 1989, "Building Theories from Case Study Research", *The Academy of Management Review,* vol. 14, no. 4, pp. 532-550.

Eisenmann, T., Parker, G. & van Alstyne, M.W. 2006, "Strategies for Two-Sided Markets", *Harvard Business Review,* vol. 84, no. 10, pp. 92-101.

Hansen, M.T., Chesbrough, H., Nohria, N. & Sull, D. 2000, "Networked incubators: hot houses of the new economy", *Harvard business review,* vol. 78, no. 5, pp. 74-84.

Hargadon, A. & Sutton, R. 1997, "Technology Brokering and Innovation in a Product Development Firm", *Administrative Science Quarterly,* vol. 42, pp. 716-749.

Howells, J. 2006, "Intermediation and role of intermediaries in innovation", *Research Policy,* vol. 35, pp. 715-728.

Huston, L. & Sakkab, N. 2006, "Connect and Develop", *Harvard business review,* vol. 84, no. 3, pp. 58-66.

Johnson, M.W., Christensen, C.M. & Kagermann, H. 2008, "Reinventing your business model", *Harvard business review,* vol. 86, no. 12, pp. 50-59.

Lichtenthaler, U. & Ernst, H. 2008, "Intermediary services in the markets for technology: Organizational antecedents and performance consequences", *Organization Studies,* vol. 29, no. 7, pp. 1003-1035.

McAdam, M., Galbraith, B., McAdam, R. & Humphreys, P. 2006, "Business processes and networks in university incubators: A review and research agendas", *Technology analysis & strategic management,* vol. 18, no. 5, pp. 451-472.

McCracken, G. 1988, *The long interview,* SAGE Publications, Inc., Newbury, CA.

Miles, M.B. & Huberman, A.M. 1994, *Qualitative data analysis,* Sage, Newbury Park, CA.

Morris, M., Schindehutte, M. & Allen, J. 2005, "The entrepreneur's business model: toward a unified perspective", *Journal of business research,* vol. 58, no. 6, pp. 726-735.

Parker, G.G. & van Alstyne, M.W. 2005, "Two-sided network effects:A theory of information product design", *Management Science,* vol. 51, no. 10, pp. 1494-1504.

Rochet, J. & Tirole, J. 2006, "Two-sided markets:A progress report", *The RAND Journal of Economics,* vol. 37, no. 3, pp. 645-667.

Rochet, J. & Tirole, J. 2003, "Platform competition in two-sided markets", *Journal of the European Economic Association,* vol. 1, no. 4, pp. 990-1029.

Teece, D.J. "Business Models, Business Strategy and Innovation", *Long range planning,* vol. forthcoming.

Verona, G., Prandelli, E. & Sawhney, M. 2006, "Innovation and virtual environments: Towards virtual knowledge brokers", *Organization Studies,* vol. 27, no. 6, pp. 765-788.

Winch, G.M. & Courtney, R. 2007, "The organization of innovation brokers: An international review", *Technology analysis & strategic management,* vol. 19, no. 6, pp. 747-763.

Yin, R.K. 2009, *Case Study Research: Design and Methods,* 4th ed. edn, SAGE Publications, Thousand Oaks, CA.

Youtie, J. & Shapira, P. 2008, "Building an innovation hub: A case of the transformation of university roles in regional technological and economic development", *Research Policy,* vol. 37, pp. 1188-1204.

Zott, C. & Amit, R. 2007, "Business model design and performance of entrepreneurial firms", *Organization Science,* vol. 18, no. 2, pp. 181-199.

Zott, C. & Amit, R. "Business Model Design: An Activity System Perspective", *Long range planning,* vol. forthcoming.

Table 1. Business model functions

Name	Value Creation	Value Capture	Value chain	Market Segment	Value network	strategy
NineSigma	*For seekers*: invokes external solvers to provide solutions on a confidential manner; supports selection and development of solutions	*From seekers*: posting and finding solution fees; consultancy services i.e. deal facilitation, training, development	NineSigma & innovation seeker meet to define goals, select innovation challenges; challenge dissemination &engagement of global innovation community; solvers provide initial solutions; assessment & acquisition or collaboration; measurement of open innovation results	Around 300 companies globally	Collaborations with industry associations and new solution providers	Large network of innovation solvers, open innovation consultancy services
	For solvers: provides a platform to sell and adapt their current technologies	*From solvers*: no transaction or membership fees are requested		2 million qualified solvers: industry, academia and gov. labs & private research inst.		
Innocentive	*For seekers*: invokes external solvers to provide solutions to conceptual challenge, licensing; supports selection, transfer and development of solutions	*From seekers:* fixed fee to post a challenge and variable fee for successful solutions to transfer IP; consultancy and training	Challenge selection and codification; distribution to external networks; solvers search on their technology platform for a solution; revision and improvement of solutions occur; selection, payment and award are given	Private and public companies seeking solutions in 60 scientific disciplines e.g. P&G, Unilever	New alliances with public & private companies, universities and foundations e.g. SAP, NASA, Rockefeller foundation	Large network of innovation solvers and open innovation consultancy
	For solvers: provides a platform to solve a conceptual challenge; transfer their technologies	*From solvers*: No fees are requested		More than 200 thousand qualified solvers		
Yet2.com	*For seekers*: Provides a platform to acquire or license-in technologies	*From seekers*: Fixed fee to post a tech. need and variable success fees, advice on IP licensing, acquisition and analysis	An anonymous tech. need is posted; tech. solutions are requested; solutions are proposed	Large (Fortune 500) and small companies seeking or selling technologies. Aprox. 100 thousand subscribed users	Strategic partners and company relationships	Large network of innovation solvers and seekers and virtual matching platform
	For solvers: Provides a platform to anonymously license-out technologies	*From solvers*: fixed membership fee and variable commission				
Innoget	*For seekers*: an Spanish network of innovation solvers; pool of available ideas	*From seekers*: no fee for posting challenge but percentage of award	Companies select an innovation challenge; solution request is evoked to an external	Spanish market and size growths through international alliances	Alliances with other technology transfer intermediaries e.g.	Problem in platform scalability and

	For solvers: provides a platform to solve international innovation challenges	*From solvers*: No fees are requested	network of solvers; solvers work on solutions; solution is selected & award is paid	Engages Spanish scientists	Yet2.com & innovation consultants	consultancy services
Pharmalicensing - Utek	*For seekers*: supports in-licensing, partnering search and business development	*From seekers*: business develop. services; other services i.e. portfolio intelligence, deal making	Seekers post an offer; potential partners are identified & contacted for an initial negotiation process	Companies interested on: in-licensing; deal-negotiation; portfolio intelligence	Alliances and partnerships with established science specialist in new markets; Utek's support	Benefits from Utek's network of innovation seekers and solvers; efficient matching platform
	For solvers: supports out-licensing within scientific fields	*From solvers*: profiling variable payment or fixed fee; variable success fee	Solvers profile their IP & licensing offers to be contacted by innovation seekers	Companies out-licensing in different industry sectors		
Teksc out - Utek	*For seekers:* advice and screen for innovation challenges	*From seekers:* an up-front posting &variable success fee; consultancy services	Synopsis of tech. request is posted; solvers formulate a proposal; solution proposals are received and selected; award is paid	Innovation solvers from scientific companies, over 2000 universities, national labs, UTEK's innovation network	Utek as principal corporate partner	Benefits from Utek's network of innovation seekers and solvers
	For solvers: outlet for technology entrepreneurs	*From solvers*: No fee				
Big Idea Group (BIG)	*For seekers*: receives a compilation of low-tech prototypes	*From seekers*: The price of acquiring a low-tech product	Inventors present ideas to BIG; ideas are screened, selected and improved; BIG present ideas to seekers; royalties are shared	Companies in consumer products and technology devices	Collaboration with communities of heterogeneous inventors	Network of solution providers; access to present ides to large companies
	For solvers: Evaluates, improves, protects inventions & match them with companies	*From solvers*: keeps a portion of royalties from sold or licensed solutions		International community of 13,000 innovation solvers		
IdeaConnection.com	*For seekers*: creates groups of innovation solvers to work on confidential inventions	*From seekers*: percentage of award from accepted solutions; fee for posting available techs.	Innovation seekers provide challenge; a sample of solvers is selected; solvers agree to work in groups; groups work for aprox. 8 weeks; 2-3 solutions are submitted; awards are paid to the winning team	Few S&P 500 companies and SMEs	Coordination with external consultants and other open innovation intermediaries i.e. InnoCentive	Automated software platform to assign solvers to challenges
	For solvers: Alternative mechanism to use their knowledge and expertise	*From solvers*: No fee for providing solutions; fixed fee for posting technologies on sale		'Thousands' of solvers with prior experience, distributed in west Europe, U.S., India		
Innovation Xchan	*For seekers:* receives tech. solutions from member partners to early-stage challenges	*From seekers & solvers:* charges an annual searching service fee	Group of IXC facilitators are trained created; facilitators work in clients day-to-day	Members of IXC are simultaneously seekers and solvers of potential	Collaboration with American companies to create	Tailored identification of existing solutions

ge (IXC)	*For solvers*: offers opportunity to license or sell proprietary IP to other trusted network members		activities to identify problems; internal facilitators meet to discuss and find solutions; partners negotiate the transfer	solutions for early-stage innovation challenges	new market opportunities and economies of scale	among network partners
Creax	*For seekers:* offers an adapted platform to solve problems by searching & filtering existing patent databases; provides insights on market potential; advice on patent strategy	*From seekers:* up-front agreed amount based on number searching hours; software solutions for idea generation, knowledge transfer, etc.	Innovation challenge is described; patent confidential search is initiated; CREAX engineers and attorneys fit patent solutions with client problem; CREAX contacts potential solvers; solution is implemented	Large and small manufacturing firms in 8 different sectors	Employees in India (70 ICT specialists responsible to restructure and update patent database, public institutions, universities	Platform and support to match IP
	For solvers: identifies potential market or applications for new solvers' products, technologies and materials	*From solvers:* No transaction fee for giving solutions; up-front amount for market studies		6000 established private companies (300 blue chip, universities & research institutes		
Youre ncore	*For seekers:* access to communities of solvers capable to work on specific projects; create forums to discuss questions, documents, etc.	*From seekers:* fixed amount for a challenge; complementary consultancy services	Advisor help to defined the challenge; solvers are matched with the challenge; ownership/ confidentiality agreements are signed; an statement of work is discussed; work is supervised; solutions are provided and work is paid	A list of over 50 member companies i.e. P&G, Lilly, Boing	Member companies as solvers and investors in Yourencore	Efficient platform to match seekers' demands with solvers; large network of innovation solvers
	For solvers: provides retirees to use their expertise on projects of their interest	*From solvers*: No fee is charged for solving solutions		Around 6000 retired experts from over 800 companies, universities		
(ICAP) Ocean Tomo	*For IP buyers:* opportunity to obtain advice and acquire anonymously IP	*For IP buyers:* IP auctions demand a buyer's premium; no fee for brokerage transactions	Detailed IP portfolio information is provided by sellers; due diligence from for bidder procedures occurs, one-to-one meetings are organized to acquire the IP	Investors or companies interested on acquiring IP	Strong relationship with ICAP and Ocean Tomo	Efficient platform to match IP technology requests from buyers and sellers
	For IP sellers: offers liquid auctions to exchange IP; 'hands-on' approach to sell IP	*From IP sellers:* fixed listing fee; commission on transaction fee		Sellers of IP i.e. inventors, companies, gov. agencies, etc.		

Appendix 1: Table A1. Sample of innovation intermediaries

Intermediary	Type	Gathering method	Intermediary	Type	Gathering method
NineSigma (U.S.)	Innovation intermediary	Long interview	Yet2.com (U.S.)	Innovation intermediary	Profile check
IdeaConnection.com (U.S.)	Innovation intermediary	Long interview	Tekscout - UTEK (USA)	Innovation intermediary	Profile check
Innoget (Spain)	Innovation intermediary	Long interview	Pharmalicensing – UTEK (UK)	Innovation intermediary	Profile check
InnoCentive (U.S.)	Innovation intermediary	Profile check	Yourencore (U.S.)	Innovation intermediary	Profile check
BIG - Big idea group (U.S.)	Innovation intermediary	Profile check	Ocean Tomo (U.S.)	Innovation intermediary	Profile check
InnovationXchange (Australia)	Innovation intermediary	Profile check	Creax (Belgium)	Innovation intermediary	Profile check